Smoke-free air laws and quit attempts: evidence for a moderating role of spontaneous self-affirmation

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Smoke-free air laws and quit attempts: Evidence for a moderating role of spontaneous self-affirmation

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***Response to Reviewers* (NO AUTHOR DETAILS)**

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Dear Dr. Johnson,

Thank you again for the constructive feedback and peer review process at *Social Science & Medicine* for our provisionally accepted manuscript (SSM-D-14-03001).

As suggested, we have modified the Abstract to add the labels for structured sub-headings (Background, Objective, Methods, Results, Conclusions).

Also, I will re-upload the manuscript with identifying author details as instructed.

Thank you again, and please let me know next steps or if anything else is needed.

Sincerely,

Alexander Persoskie

Highlights:

- Smoke-free laws may promote cessation, but only if smokers do not react defensively
- People who self-affirm (reflect on their values) respond to threat less defensively
- Strong smoke-free laws are associated with quit attempts in smokers who self-affirm

Smoke-free air laws and quit attempts: Evidence for a moderating role of spontaneous self-affirmation

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Background: In addition to their primary goal of protecting nonsmokers from secondhand smoke, smoke-free air laws may also encourage intentions to quit smoking, quit attempts, and cessation among smokers. However, laws may not encourage quitting if smokers feel threatened by them and react defensively. **Objective**: This study examined whether spontaneous self-affirmation – the extent to which people think about their values or strengths when they feel threatened – may reduce smokers' reactance to smoke-free laws, enhancing the ability of the laws to encourage quitting. **Methods**: We linked state-level information on the comprehensiveness of U.S. smoke-free laws (compiled in January, 2013 by the American Lung Association) with data from a U.S. health survey (Health Information National Trends Survey) collected from September-December, 2013 (*N*=345 current smokers; 587 former smokers). **Results**: Smoke-free laws interacted with self-affirmation to predict quit attempts in the past year and intentions to quit in the next six months: Smokers higher in self-affirmation reported more quit attempts and quit intentions if they lived in states with more comprehensive smoke-free laws. There was some evidence of a "boomerang" effect (i.e., less likelihood of making a quit attempt) among smokers low in self-affirmation if living in states with more comprehensive smoke-free laws, but this effect was significant only among smokers extremely low in self-affirmation. For quit intentions, there was no evidence for a boomerang effect of smoke-free laws even among smokers extremely low in self-affirmation. More comprehensive smoke-free laws were not associated with smoking status (former vs. current smoker) or average amount smoked per day, nor did they interact with self-affirmation to predict these outcomes. **Conclusions**: The impact of smoke-free policies on quit attempts and quit intentions may be moderated by psychological characteristics such as the tendency to spontaneously self-affirm. Follow-ups should

experimentally manipulate self-affirmation and examine effects of smoke-free laws in controlled contexts.

Keywords: smoke-free, tobacco control, self-affirmation, defensive processing, reactance

Introduction

Smoke-free air laws – which ban or restrict smoking in areas such as restaurants, hotels, public transportation, and workplaces – are effective in protecting nonsmokers from secondhand smoke (Callinan, Clarke, Doherty, & Kelleher, 2010; U.S. Department of Health and Human Services, 2006). They may also reduce rates of smoking initiation among youth (Siegel, Albers, Cheng, Hamilton, & Biener, 2008). A secondary benefit of such laws is that they may influence the smoking-related attitudes, intentions, and behaviors of smokers. Specifically, smoke-free laws may reduce the social acceptability of smoking, make smoking less convenient, and reinforce the fact that tobacco smoke is harmful to health (Bernat, Erickson, Shi, Fabian, & Forster, 2010; Rayens et al., 2007). Smoke-free laws thus have the potential to encourage quit attempts, quit intentions, and quit rates among smokers (Fowkes, Stewart, Fowkes, Amos, & Praice, 2008; Hackshaw, McEwen, West, & Bauld, 2010; Nagelhout et al., 2012).

However, smoke-free laws may not necessarily increase rates of smoking cessation (Hahn, Rayens, Langley, Adkins, & Dignan, 2010). Indeed, a recent systematic review found that "the effect of smoking bans on smoking prevalence was inconclusive," with a trend toward a reduction in prevalence (Callinan et al., 2010, p. 11). The International Tobacco Control (ITC) Conceptual Model proposes that the behavioral effects of tobacco control policies will be moderated by a range of factors such as individuals' psychological characteristics (e.g., stress, time perspective) (Fong et al., 2006). Thus, there is a need for research on psychological factors that may moderate the ability of smoke-free legislation to promote cessation.

Smoke-free laws may not succeed in encouraging quitting if they evoke defensive responses or reactance among smokers. Psychological reactance is a phenomenon whereby externally imposed constraints on a particular behavior can increase people's motivation to

engage in the behavior in an attempt to restore feelings of personal freedom (Brehm, 1966). For example, a law raising the legal drinking age may increase alcohol consumption among drinkers who are newly "underage" if they perceive a reduction in their freedom (Allen, Sprenkel, & Vitale, 1994). Reactance has been documented in response to health warnings against risky behaviors such as alcohol use (Richards & Banas, 2014) and smoking (Freeman, Hennessy, & Marzullo, 2001; Rhodes, Roskos-Ewoldsen, Edison, & Bradford, 2008). People exhibit greater reactance when they perceive less ability to choose their own actions (Miller, Lane, Deatrick, Young, & Potts, 2007). Other defensive reactions such as derogating risk information and downplaying personal vulnerability can also occur in response to communications about health threats (Harris, Mayle, Mabbott, & Napper, 2007; Erceg-Hurn & Steed, 2011; McQueen, Vernon, & Swank, 2012; Schüz, Schüz, & Eid, 2013). It may benefit public health to understand and, if possible, to avoid such "boomerang" effects in the implementation of smoke-free laws.

An important psychological construct that has been shown to reduce defensive reactions to threatening information is self-affirmation. Self-Affirmation Theory (Steele, 1988) holds that individuals seek to maintain perceptions of self-integrity – that is, views of themselves as competent, consistent, and moral individuals. When self-integrity is threatened – e.g., by the suggestion that one's behavior is unhealthy, or by a policy prohibiting the expression of some aspect of one's identity (such as smoking) – people may process the information defensively to protect their self-integrity. For example, in one study, smokers who viewed smoking as an important part of their identity responded more defensively to antismoking videos (Freeman et al., 2001). *Self-affirmation* is a process by which people can bolster their self-integrity by reflecting on their values or strengths, which can allow them to face threats to self-integrity without reacting defensively (Cohen & Sherman, 2014). Self-affirmation has been shown to

enhance people's attention to health messages, perceptions of risk, intentions to engage in protective behaviors, and behavior change (Cohen & Sherman, 2014). In the domain of smoking, self-affirmation can reduce defensive responding to warning labels, increase acceptance of anti-smoking messages, and promote quit intentions (Armitage, Harris, Hepton, & Napper, 2008; Harris et al., 2007). Given these effects, it may also mitigate the potential self-threat associated with smoke-free laws.

Self-affirmation can be induced by asking people to reflect on an important value and how they adhere to it in everyday life (McQueen & Klein, 2006). However, people may also spontaneously engage in activities to self-affirm, particularly when experiencing psychological threats (e.g., by writing about life events, viewing social media, or consuming certain goods; Creswell et al., 2007; Sivanathan & Pettit, 2010; Toma & Hancock, 2013; Townsend & Sood, 2012). Indeed, recent studies have assessed individual differences in the tendency to self-affirm when under threat (Harris, Napper, Griffin, Schüz, & Stride, 2014; Pietersma & Dijkstra, 2012, Taber et al., 2015c), and research shows that self-affirming can offset defensiveness even after a threat has been encountered (Briñol, Petty, Gallardo, & DeMarree, 2007). Spontaneous self-affirmation thus holds promise for reducing defensiveness to potential self-threats from smoke-free policies.

Although no studies to our knowledge have directly tested whether self-affirmation can reduce psychological reactance to policies that restrict certain behaviors, it should be noted that the perception that one is free to make choices is central to self-integrity (Steele, 1988). Self-affirmation may thus reduce the motivation to assert one's freedom in response to restrictions on behavior. Accordingly, self-affirmation may moderate the behavioral effects of smoke-free laws, which directly limit smoking in certain places (Bernat et al., 2010) in addition to implicitly

conveying information about the harms and undesirability of smoking (Rayens et al., 2007). The current study assessed this possibility by exploring whether spontaneous self-affirmation moderated the association between smoke-free laws and smoking-related behaviors and intentions (current smoking, quit attempts, quit intentions, and amount smoked). This study will add to the current literature by examining the role of self-affirmation with respect to policy (an association rarely examined previously) using data from a national survey. If self-affirmation moderates the effects of smoke-free laws on smoking behavior, then it may have intervention implications; for example, it may be possible to design affirmation-based interventions to accompany the implementation of smoke-free laws.

Methods

Data Sources

Data on smoking behavior, spontaneous self-affirmation, and demographic variables were gathered from the National Cancer Institute's Health Information National Trends Survey (HINTS) 4 Cycle 3. This nationally representative, cross-sectional mail survey assessed cancer information seeking and health behaviors such as smoking, diet, and exercise. HINTS data were collected between September and December of 2013. U.S. households were selected using a random sample of U.S. addresses; within each household, one adult was selected based on proximity of birth date to survey date. A complex sampling design was employed and high minority areas were oversampled. Sample weights were employed to account for the complex sampling design, as well as for household nonresponse, and are used to calculate appropriate standard errors for statistical procedures and to generate nationally representative estimates.

The overall weighted response rate for HINTS 4 Cycle 3 was 35.2%, which is consistent with other mailed surveys (Dillman, 2000). Of the 12,010 households selected to receive a

mailing, there were 79 refusals, 7134 nonresponses, and 1612 mailings returned as undeliverable (Westat, 2014). In total, 3185 individuals returned surveys that were either "complete" (n = 3124), meaning that at least 80% of required questions had been answered in the first two sections of the survey, or "partially complete" (n = 61), meaning that between 50 and 79% of the required questions were answered (Westat, 2014, p. 14). On the variables assessed here, the extent of missing data on each of the items was: gender (n = 82, 2.6%), age (n = 103, 3.2%), education (n = 89, 2.8%), income (n = 446, 14.0%), race/ethnicity (n = 460, 14.4%), self-affirmation variables (n = 186, 5.8%; and n = 193, 6.0%), and smoking variables: smoked 100 cigarettes (n = 22, 0.6%), currently smoking every day, some days, or not at all (n = 23, 1.6%), average amount smoked daily (n = 4; 0.8%), seriously considering quitting smoking (n = 5, 1.0%), and quit attempts in the past year (n = 5, 1.0%). We examined data only from a subsample of 932 current or former smokers with data on all demographic variables, self-affirmation, and – among current smokers – quit attempts, quit intentions, and average amount smoked per day. This subsample included respondents from all U.S. states and Washington, DC, with the exception of Alaska, Idaho, North Dakota, South Dakota, and Vermont. Further details of the survey are available at: http://hints.cancer.gov/instrument.aspx. Federal Information Processing Standard (FIPS) state codes (http://www.epa.gov/envirofw/html/codes/state.html) were used to link these data with state-level data on smoke-free air laws.

Data on smoke-free air laws were gathered from the American Lung Association's (ALA) 2013 evaluation of the comprehensiveness of U.S. states' smoke-free laws (ALA, 2013). These data were based on policies that were in effect as of January 2, 2013. The scoring system for smoke-free air laws was based on criteria developed by an expert panel convened by the National Cancer Institute and presented in Chriqui et al. (2002). The overall score for each state

reflects the comprehensiveness of its smoke-free laws in eleven categories, including restaurants, retail stores, bars, casinos and gambling establishments (in states where gambling is legal), schools, child care facilities, recreational and cultural facilities, government workplaces, private workplaces, penalties, and enforcement. States could be awarded up to four points in each category. Bonus points were also available in some categories. For example, for private workplaces, "A bonus point (+1) was available if the laws met the target criteria and required the grounds or a specified distance from entries or exits to be smokefree" (ALA, 2013, p. 44). Smoke-free air scores were computed by the ALA as the sum of points across all categories and could reach a maximum score of 44 (for states that allow casinos) or 40 (for states that do not allow casinos). Each state's score was converted to the fraction of the total points possible for that state.

To assess the novelty of the smoke-free laws, we examined the change in scores between the 2012 and 2013 ALA reports, finding that the scores of only 2 states (Indiana and North Dakota) changed between these years, with an overall Pearson correlation of 0.94 between 2012 and 2013 scores. From 2011 to 2012, the scores were also highly stable, with very slight changes in the scores of only five states and a Pearson r of 0.999. This suggests that almost all of the laws were in effect for multiple years before our assessments of smoking behavior and intentions.

Measures

Spontaneous self-affirmation was assessed by asking respondents to agree or disagree with two statements on a 4-point scale from 1 (*Strongly disagree*) to 4 (*Strongly agree*): "When I feel threatened or anxious I find myself thinking about my strengths," and "When I feel threatened or anxious I find myself thinking about my values." Responses to these items were averaged to create a composite measure of self-affirmation tendency (Cronbach's alpha = 0.83).

These items were selected for inclusion on the HINTS survey from the full scale (Harris et al., 2015). Both items correlate well with the full scale, which predicts scores on various published indices of self-affirmation (e.g., Napper, Harris & Epton, 2009; Pietersma & Dijkstra, 2012; Sherman, Nelson & Steele, 2000). Analyses conducted using either of the two items alone led to results that were similar to those found using the composite measure. Cronbach's alpha was calculated using unweighted data. Of note, the self-affirmation items in this HINTS dataset have been used elsewhere to examine the association of self-affirmation with well-being (Emanuel et al., 2015), with aspects of the health care experience and information seeking (Taber et al., 2015a), and with indicators of physical, mental, and cognitive health and information seeking among cancer survivors (Taber et al., 2015b).

Smoking status was determined using two questions (Centers for Disease Control and Prevention, 2014). Current smokers were defined as those who reported smoking at least 100 cigarettes in their entire lives and currently smoking "Everyday" or "Some days." Former smokers were defined as those who reported smoking at least 100 cigarettes in their entire lives and currently smoking "Not at all." Current smokers were asked three follow-up questions about their smoking behavior: At any time in the past year, have you stopped smoking for one day or longer because you were trying to quit? (*Yes/ No*), Are you seriously considering quitting smoking in the next six months? (*Yes/ No*), and On the average, when you smoked during the past 30 days, about how many cigarettes did you smoke a day? (5 categories: *1-10, 11-19, 20, 21-39, 40+*) To reduce skew, responses to the last item were re-coded into a 3-category scale (*1-10, 11-19, 20+*), although analyses conducted without recoding this variable led to results consistent with the reported findings.

Demographic characteristics were also assessed. Respondents reported their gender, age, highest level of education, annual household income, race, and ethnicity. All analyses controlled for these factors.

Statistical Analyses

Weighted hierarchical regressions tested whether smoke-free laws, self-affirmation, and their interaction were associated with smoking behavior, including current smoking status (current vs. former), making quit attempts, quit intentions, and current amount smoked. In the first step of each regression, we entered demographic characteristics, smoke-free score, and self-affirmation scores. In the second step, we added the interaction between smoke-free score and self-affirmation. The regressions were logistic for analyses of the dichotomous variables (smoking status, quit attempts and quit intentions), and linear for amount smoked. The analytic sample for analyses of quit attempts, quit intentions, and amount smoked included respondents who were current smokers and had valid data on all demographic variables, quit attempts, quit intentions, and average amount smoked per day. The analysis of smoking status used an expanded sample that also included former smokers. No imputation strategy was used to replace missing data. To account for the complex sampling design of HINTS, a set of 50 jackknife replicate weights were used in all analyses, as is recommended for analyses of these data (Westat, 2014). Analyses were conducted using SAS-callable SUDAAN version 11.0.0 (RTI, Research Triangle Park, NC).

Results

Demographics and Smoking Status

Table 1 shows the demographic characteristics of current (n = 345) and former (n = 587) smokers. The analytic sample included respondents with a wide range of demographic

characteristics. Smoke-free scores ranged from 0 to 1.09, with a mean of 0.79, a standard deviation (based on unweighted data) of 0.29, and a Fisher-Pearson coefficient of skewness (Doane & Seward, 2011) of -1.19, indicating a negative skew. Self-affirmation scores ranged from 1 to 4 with a mean of 2.69 (2.75 among current smokers only), and an SD (unweighted) of 0.85 (0.84 among current smokers only).

As shown in Table 1, a weighted logistic regression found that older respondents were less likely than the youngest respondents to be current rather than former smokers. Less educated respondents were more likely to be current smokers, as were blacks compared to whites. Respondents scoring higher on the self-affirmation index were more likely to be current rather than former smokers. There was no significant association between smoking status and state smoke-free score. When the interaction term (self-affirmation x smoke-free score) was added to the model, there was no evidence of an interaction (*OR* = 1.08, *95% CI:* 0.33-3.49, *p* = .898) with smoking status as the dependent variable.

[Table 1]

Quit Attempts, Quit Intentions, and Amount Smoked

Table 2 shows the distribution of quit attempts, quit intentions, and amount smoked among current smokers. Table 3 displays associations of these variables with sociodemographic factors, spontaneous self-affirmation, and smoke-free scores. Older respondents were less likely than the youngest respondents to make quit attempts and tended to smoke more cigarettes on average. Respondents who scored higher on the self-affirmation index were more likely to intend to quit smoking, but self-affirmation was not associated with quit attempts or amount smoked. There was no main effect of smoke-free air laws on quit attempts, quit intentions, or amount smoked.

[Table 2]

[Table 3]

When the interaction term (self-affirmation x smoke-free score) was added to each model, significant interactions emerged for quit attempts (*OR* = 11.35, *95% CI:* 1.41-91.53, *p* = .024) and quit intentions (*OR* = 6.68, *95% CI:* 1.11-40.13, *p* = .038) but not for amount smoked (*B* = -0.12, *95% CI:* -0.74-0.50, *p* = .702). Simple slopes analyses were conducted to explore the significant interactions for quit attempts and quit intentions (Aiken & West, 1991). Specifically, we reran each full regression model after centering self-affirmation at different values and recalculating the interaction term. This allowed us to examine the association between smoke-free legislation and quit attempts and quit intentions at high and low levels of self-affirmation (Aiken & West, 1991). In particular, we reran the full regression model 10 times, including with self-affirmation centered at six values below its mean (0.33, 0.66, 1.00, 1.33, 1.66, and 2.00 standard deviations (SDs) below the mean) and at four values above its mean (0.33, 0.66, 1.00, and 1.33 SDs above the mean). We did not examine 1.66 or 2.00 SDs above the mean because these values of self-affirmation (4.14 and 4.42) would exceed the top of the self-affirmation scale, which ranged from 1 to 4.

Consistent with predictions, among smokers high in self-affirmation, those living in locations with more comprehensive smoke-free air laws reported more quit attempts. This effect was not significant when self-affirmation was only 0.33 SDs above the mean (3.03; *OR* = 2.86, *95% CI*: 0.67-12.08, *p* = .150), but approached significance at 0.66 SDs above the mean (3.30; *OR* = 5.58, *95% CI*: 0.94-33.01, *p* = .058) and was significant at 1.00 SD above the mean (3.59; *OR* = 11.12, *95% CI*: 1.20-103.28, *p* = .035) or higher. For example, when self-affirmation was 1 SD above the mean, an increase in smoke-free score from 0.54 (the middle of the range of

smoke-free scores) to 1.09 (the highest smoke-free score) was associated with an increase in predicted probability of making a quit attempt from 0.59 to 0.85.

On the other hand, among smokers low in self-affirmation, higher smoke-free scores were associated with a lower likelihood of making a quit attempt. This effect did not approach statistical significance until self-affirmation was very low, 1.66 SDs below the mean (1.36; *OR* = 0.05, *95% CI*: 0.00-1.12, *p* = .058), and did not achieve significance until even lower, 2.00 SDs below the mean (1.08; *OR* = 0.03, *95% CI*: 0.00-0.97, *p* = .048). Figure 1 shows the predicted probabilities of making a quit attempt depending on smoke-free score and level of self-affirmation.

[Figure 1]

A similar pattern emerged for quit intentions in the next six months. For smokers higher than average in self-affirmation, there was a positive association between smoke-free laws and intentions to quit smoking that did not reach significance at 0.66 SDs above the mean of self-affirmation (3.30; *OR* = 4.62, *95% CI*: 0.87-24.61, *p* = .072) but attained significance at 1.00 SD above the mean (3.59; *OR* = 7.92, *95% CI*: 1.03-60.61, *p* = .047). For smokers lower than average in self-affirmation, the association between smoke-free score and quit intentions did not reach statistical significance even at 2 SDs below the mean for self-affirmation (1.08; *OR* = 0.07, *95% CI*: 0.00-1.65, *p* = .097). Figure 2 displays predicted probabilities of intending to quit depending on smoke-free scores and self-affirmation. For example, when self-affirmation was 1 SD above the mean (3.59 on a 4-point scale), an increase in smoke-free score from the midpoint of the range (0.54) to the top of the range (1.09) was associated with an increase in predicted probability of intending to quit from 0.76 to 0.91.

[Figure 2]

Supplementary Analyses

A series of follow-up analyses was conducted to test the robustness and sensitivity of the results concerning the interactions between smoke-free scores and self-affirmation. First, we tested the potential influence of outliers on the results. Respondents scoring greater than 2 SDs below the mean on the self-affirmation measure were recoded to the closest score within 2 SDs of the mean; 24 current smokers and 60 former smokers scoring a 1 were recoded to a 1.5 (no respondents scored greater than 2 SDs above the mean as this value was beyond the range of the scale). Analyses using this capped measure of self-affirmation led to results that were identical to those reported above in terms of direction and significance. Similarly, respondents from states with very high or very low smoke-free scores (outside 2 SDs from the mean) were recoded to the closest score within 2 SDs of the mean; 8 current smokers and 17 former smokers were recoded from 0-0.16 to 0.20. Again, the pattern and significance of results using this capped measure of smoke-free score replicated those from the analyses reported above.

An additional follow-up analysis tested the robustness of the results to variations in the coding of smoke-free scores. In the analyses reported above, smoke-free score was treated as a continuous variable (0-1.09), and, as noted, there was a negative skew (-1.19) in the distribution. In a follow-up analysis, we re-coded smoke-free scores into three categories of roughly equal size: 0-0.77 (121 smokers; 144 former smokers), 0.78-0.93 (124 smokers; 259 former smokers), and 0.94-1.09 (100 smokers; 184 former smokers). This categorical variable had very little skew, -0.03. Results using this categorical variable were similar, though not identical, to those reported earlier. There was a significant interaction between smoke-free score and self-affirmation in predicting quit attempts (*OR* = 2.29, *95% CI*: 1.05-4.97, $p = .037$). The interaction between smoke-free score and self-affirmation approached but did not reach significance in predicting

quit intentions (*OR* = 1.97, *95% CI*: 0.97-4.03, *p* = .061). As previously, smoke-free score and self-affirmation did not interact in predicting amount smoked (*B* = -0.16, *95% CI*: -0.36-0.05, *p* = .130) or current smoking status (current vs. former; *OR* = 0.95, *95% CI*: 0.60-1.52, *p* = .842).

An alternative method of categorizing smoke-free scores was also examined: specifically, the range of smoke-free scores was divided into three roughly equal ranges: low (0-0.36; 80 smokers; 94 former smokers), medium (0.37-0.71; 19 smokers; 27 former smokers), and high (0.72-1.09; 246 smokers; 466 former smokers). This categorical variable was somewhat more negatively skewed than the original continuous variable (-1.41 vs. -1.19). Using this rough categorization, smoke-free score marginally interacted with self-affirmation to predict quit attempts (*OR* = 2.06, *95% CI*: 0.99-4.30, *p* = .053), but not quit intentions (*OR* = 1.69, *95% CI*: 0.88-3.24, *p* = .112), amount smoked (*B* = -0.05, *95% CI*: -0.26-0.15, *p* = .615), or smoking status (*OR* = 1.09, *95% CI*: 0.67-1.76, *p* = .730).

We note that dividing a continuous scale into discrete categories using either of the methods used in these supplementary analyses requires drawing potentially arbitrary distinctions among scores. This can result in lost information and reduced statistical power. However, when presented in conjunction with the results using the original continuous variable, such analyses may provide additional information about the robustness of effects.

Discussion

The present study found evidence that spontaneous self-affirmation may moderate the association between the comprehensiveness of state-level smoke-free laws and quit attempts and quit intentions. Current smokers who were higher in self-affirmation were more likely to report making a quit attempt and intending to quit when living in locations with more comprehensive smoke-free air laws, suggesting that smoke-free laws may encourage cessation among these

individuals. This may be a significant secondary benefit of smoke-free laws, in addition to their primary purpose of protecting nonsmokers from exposure to secondhand smoke (Callinan et al., 2010; U.S. Department of Health and Human Services, 2006). Indeed, a recent study found that smokers who expressed support for restricting smoking in public venues were more likely to quit smoking in the next year (Nagelhout, Zhuang, Gamst, & Zhu, 2015). Future research might examine whether spontaneous self-affirmation mediates this association; specifically, smokers higher versus lower in spontaneous self-affirmation may be more supportive of smoke-free laws, as they may see these laws as a tool to help them quit smoking.

In contrast, among smokers who were lower in self-affirmation, there was some evidence of an ironic effect of smoke-free laws on quit attempts (i.e., reduced likelihood of making a quit attempt among those living in states with stronger smoke-free laws). This is consistent with the phenomenon of psychological reactance, in which externally imposed constraints on a behavior can increase people's motivation to engage in the behavior in order to restore feelings of personal freedom (Brehm, 1966; Allen et al., 1994). However, this effect did not appear to be as strong as the positive effect observed among high self-affirmers, as it only reached statistical significance among those extremely low in self-affirmation (2 SDs below the mean). Moreover, the negative association between smoke-free laws and quit *intentions* did not reach statistical significance even among those extremely low in self-affirmation (2 SDs below the mean). Nevertheless, these findings raise the possibility that self-affirmation characteristics may moderate smokers' responses to smoke-free policies.

Among our other two outcome measures – current smoking status and amount smoked per day – we found no moderated or overall associations with the comprehensiveness of state smoke-free air laws. A post hoc explanation for this finding is that smoke-free air laws increase

current smokers' desire to quit but have smaller effects on sustained behavior (smoking status and amount smoked) because of the addictiveness of tobacco. It is well known that smoking cessation often requires many quit attempts (Zhou et al., 2008), and, although the motivation to quit is sufficient to prompt quit attempts, it does not ensure the maintenance of cessation (Borland et al., 2010). Over time, increased quit attempts may translate into effects on current smoking status. Some studies have indeed found effects of smoke-free laws on smoking prevalence and amount smoked, though the effects have been limited (Callinan et al., 2010; Schillo et al., 2012). However, the relationship between state policies and smoking behavior may be diluted by other factors in the environment, such as local smoke-free ordinances, or at the individual level. Also, our statistical power to detect associations between smoke-free laws and smoking behavior was limited by the study's modest sample size. Thus, continued research using different types of moderators (e.g., strength of nicotine dependence) and larger sample sizes is needed to further explore the impact of smoke-free laws on these outcomes.

One unexpected result of this study was the finding that respondents scoring higher on the self-affirmation index were more likely to be current rather than former smokers. This result runs counter to studies finding positive effects of self-affirmation on processing of health information and engagement in health protective behaviors (Armitage, Harris, & Arden, 2011; Cohen & Sherman, 2014; Epton, Harris, Kane, van Koningsbruggen, & Sheeran, 2015). However, the majority of these prior findings involved experimental inductions of self-affirmation, and much less is known about demographic or health behavior correlates of spontaneously affirming in response to threat in everyday life (Harris et al., 2015). One unpublished study using the larger HINTS sample from which the current study was taken demonstrated that self-affirmation tendencies are higher in older individuals and black and

Hispanic compared to white adults (Emanuel et al., 2015). However, it is unknown to what extent threatening circumstances may promote self-affirmation as a strategy to cope. Also, it is worth noting that, although self-affirmation typically increases openness to health information, "whether the moment of openness then prompts enduring changes in behavior … hinges on other factors" (Cohen & Sherman, 2014, p. 348). In particular, there are considerable barriers to long-term behavior change in smoking, such as strong cravings and the need to avoid "high-risk" situations (i.e., those that provoke cravings) that could lead to a relapse (Sayette, Loewenstein, Griffin, & Black, 2008). Finally, it is also possible that the association between self-affirmation and current smoking observed here was a recruitment effect: Current smokers may have been more reluctant than former smokers to take part in a health survey, and self-affirmation may have moderated this tendency with the result that people higher in self-affirmation were over-represented among current smokers. Clearly, more evidence is needed concerning the association between self-affirmation and smoking status, as well as other factors that may moderate this association.

Limitations

This study's cross-sectional design prohibits the determination of causality. Our aim is to stimulate further social psychological and communication research on smoke-free laws and other areas of tobacco control, as psychologists and communication scientists have much to add in terms of maximizing the potency, targeting, and effectiveness of tobacco policies (Strahan et al., 2002; Klein, Shepperd, Suls, Rothman, & Croyle, 2014). A second limitation is that smoking-related behaviors were self-reported. However, outside of subpopulations such as pregnant women and underage youth, research has found no evidence that self-reports of quit attempts and smoking status are biased by social desirability concerns (Patrick et al., 1994; Persoskie &

Nelson, 2013; Yeager & Krosnick, 2010). A third limitation is that our analyses focused on state-level policies (ALA, 2013). Variation in smoke-free policies also exists within individual states (e.g., at the city and county levels), and future studies should extend the present results by examining the effects of policy variations at more granular levels. We see particular value in studies assessing smokers' behavior before and after the implementation of smoke-free policies in specific settings such as workplaces. Such studies avoid an additional limitation of the present research, which is that we could not assess the extent to which respondents were affected by the laws (e.g., some respondents may have spent more time in their own homes than did others). Finally, this study was conducted with a relatively modest sample size. Conclusions about the overall effects of smoke-free laws on quitting behavior should be derived from much larger studies, systematic reviews, and meta-analyses (Callinan et al., 2010).

Implications

Our results point to several intriguing possibilities concerning the effects of smoke-free laws on quit attempts, all requiring further empirical investigation. Research has examined personality traits such as sensation seeking and trait reactance as factors that may *increase* reactance (Quick & Stephenson, 2008), but less work has examined individual differences that may *reduce* reactance. Because self-affirmation can be induced, the present data have important implications. Smoke-free laws may be more effective in encouraging quit attempts among people who spontaneously self-affirm when under threat, compared to those who do not. For people who do not spontaneously self-affirm, it may be possible to encourage self-affirmation by informing people about smoke-free laws on social media, where the viewing of one's online profile tends to act as a self-affirmation (Toma & Hancock, 2013; Toma, 2010). Simply asking people to reflect on their values and strengths, to think about times when they have been kind to

others, or to generate a plan to self-affirm when threatened have also been shown to reduce defensiveness and encourage adoption of healthy behaviors (Epton et al., in press; Armitage et al., 2011; Reed & Aspinwall, 1998; see Cohen & Sherman, 2014; McQueen & Klein, 2006). It may be possible to incorporate self-affirmation techniques into the implementation of new smoke-free laws – for example, through a media campaign timed to coincide with the implementation of the new law (McGoldrick & Boonn, 2010). Such techniques may maximize the public health benefits of smoke-free laws if they reduce smokers' psychological reactance and encourage cessation, without compromising the laws' primary aim of protecting nonsmokers. Of note, the implications may also extend to understanding reactance in the context of other health messages or laws that may imply constraints on behavior, such as restrictions on the use of electronic cigarettes in public places (World Health Organization, 2014).

Research is also needed to address several additional questions raised by the present findings. First, what are the mechanisms underlying the moderating effects of self-affirmation observed here? There are several psychological processes upon which self-affirmation may act, such as defensiveness toward changes in smoking norms, reactance to perceived restriction on the freedom to smoke, and defensive processing of the health risk implications of smoke-free laws (Cohen & Sherman, 2014). Research also indicates that self-affirmation can reduce ironic effects associated with thought-suppression (Koole & van Knippenberg, 2007) and can enhance self-control (Schmeichel & Vohs, 2009) and psychological resources (Shea & Masicampo, 2014), which suggests it may be a means of avoiding pro-smoking thoughts or cravings that arise when smokers encounter a smoke-free policy (Earp, Dill, Harris, Ackerman, & Bargh, 2013), or may increase resources to cope with them. Further, reactance may take the form of anger or negative

cognitions (Dillard & Shen, 2005). Future research should test the psychological mechanisms by which smoke-free laws influence cessation and how self-affirmation acts on these processes.

Second, other methods of reducing smokers' potential defensiveness toward smoke-free laws, aside from self-affirmation, should be explored. For example, there are many ways to alert the public and enforce smoke-free legislation (e.g., imposing a fine; posting signage about the harms of secondhand smoke), some of which may be more or less psychologically threatening than others. Other strategies, such as "restoration" or "inoculation" messages that somehow indicate freedom of choice have been shown to reduce reactance in other settings (Albarracin, Durantini, Earl, Gunnoe, & Leeper, 2008; Miller et al., 2007; Richards & Banas, 2014) and could be employed in signs denoting smoke-free environments. Valuable insights may also emerge from understanding the mechanisms underlying the increased public support for smoke-free laws that tends to occur over time, including among smokers, following their implementation (U.S. Department of Health and Human Services, 2006). Finally, it may be especially productive to study defensiveness to smoke-free policies in particular locations that may evoke threat – for example, in multiunit housing, given that "private homes have long been considered spaces beyond the legitimate reach of regulation" (Winickoff, Gottlieb, & Mello, 2010, p. 2319; see also Wilson, Klein, Blumkin, Gottlieb, & Winickoff, 2011).

Conclusion

The impact of smoke-free policies on quit attempts and quit intentions may be moderated by psychological characteristics such as the tendency to spontaneously self-affirm. Thus, it may be possible to improve the implementation of smoke-free laws and other policies encouraging healthy behaviors by using self-affirmation techniques (Ehret & Sherman, in press). However,

follow-up studies are needed in which self-affirmation is experimentally manipulated and the effects of smoke-free laws are observed in a pre-post design.

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Table 1
Demographic characteristics and weighted associations with current smoking status

	Current Smokers		Former Smokers				
Characteristic	*n* or mean	%	*n* or mean	%	*OR*	*95% CI*	*p*
N	345	100.0	587	100.0			
Gender							
Female	194	45.9	283	38.6	1.00 (REF)		
Male	151	54.1	304	61.4	0.69	0.39-1.21	.186
Age							
18-34	64	34.5	60	22.3	1.00 (REF)		
35-49	102	38.1	95	25.4	0.93	0.40-2.14	.857
50-64	128	21.3	208	28.0	0.42	0.19-0.91	.029
>64	51	6.1	224	24.4	0.11	0.04-0.27	<.001
Education							
≤ Some High School	45	12.0	33	3.1	7.64	2.35-24.78	.001
High School Graduate	146	47.7	158	27.3	5.57	2.83-10.97	<.001
Some College	86	23.4	142	31.6	1.83	0.80-4.18	.147
College Graduate	68	16.8	254	38.0	1.00 (REF)		
Household Income ($)							
<$20,000	139	26.8	110	15.3	1.00 (REF)		
$20,000 to <$35,000	56	16.0	83	12.1	1.05	0.40-2.76	.915
$35,000 to <$50,000	52	16.9	97	18.0	0.64	0.31-1.33	.226
$50,000 to <$75,000	40	13.0	112	19.1	0.58	0.27-1.22	.145
$75,000 or more	58	27.3	185	35.6	0.81	0.38-1.74	.589
Ethnicity							
Non-Hispanic	303	89.4	514	90.8	1.00 (REF)		
Hispanic	42	10.6	73	9.2	0.99	0.39-2.48	.980
Race							
White	242	77.7	486	88.3	1.00 (REF)		
Black/ African American	65	13.4	59	5.5	3.00	1.27-7.07	.013
Other	38	8.9	42	6.3	1.58	0.58-4.34	.364
Self-Affirmation	2.75		2.64		1.44	1.03-2.01	.034
Smoke-Free Air Score	0.77		0.81		0.95	0.33-2.69	.918

Note. Values reflect unweighted counts (*n*), weighted percentages (%), and means. Odds ratios (*OR*s) are from a weighted logistic regression predicting current smoking status (1 = current smoker; 0 = former smoker) in which predictors were entered simultaneously.

Table 2
Quit attempts, quit intentions, and amount smoked

Behavior or intention	*n* (%)
N	345 (100)
Made a Quit Attempt in Past Year[a]	
No	131 (38.1)
Yes	214 (61.9)
Considering Quitting in Next 6 Months[a]	
No	102 (31.5)
Yes	243 (68.5)
Average Cigarettes Smoked per Day	
1-10	194 (58.0)
11-19	66 (21.9)
20[b]	40 (7.5)
21-39[b]	32 (9.8)
40+[b]	13 (2.8)

Note. Unweighted *n*s and weighted %s.
[a] There was moderate overlap in these two variables. 43.5% of respondents who did not make a quit attempt in the past year were seriously considering quitting in the next 6 months. 86.9% of those who made a quit attempt in the past year were seriously considering quitting in the next 6 months.
[b] These responses were collapsed into a single category (20+) in the analysis of amount smoked reported here.

Table 3
Weighted associations with quit attempts, quit intentions, and amount smoked

	Quit Attempt			Quit Intentions			Amount Smoked		
Characteristic	*OR*	*95% CI*	*p*	*OR*	*95% CI*	*p*	*B*	*95% CI*	*p*
Gender									
Female	1.00 (REF)			1.00 (REF)			… (REF)		
Male	1.21	0.50,2.92	.663	0.85	0.34,2.11	.715	0.16	-0.11,0.44	.243
Age									
18-34	1.00 (REF)			1.00 (REF)			… (REF)		
35-49	0.61	0.19,1.92	.387	0.54	0.13,2.19	.381	0.25	-0.12,0.62	.183
50-64	0.34	0.13,0.92	.034	0.35	0.09,1.30	.113	0.37	-0.08,0.81	.106
>64	0.35	0.10,1.23	.098	0.33	0.07,1.60	.164	0.59	0.19,0.99	.005
Education									
≤ Some High School	1.86	0.35,9.88	.459	1.39	0.24,8.11	.709	0.36	-0.37,1.10	.326
High School Graduate	1.00	0.38,2.65	.997	0.44	0.12,1.59	.205	0.26	-0.05,0.57	.098
Some College	0.73	0.20,2.65	.631	1.09	0.25,4.81	.909	0.12	-0.24,0.48	.500
College Graduate	1.00 (REF)			1.00 (REF)			… (REF)		
Household Income ($)									
<$20,000 (REF)	1.00 (REF)			1.00 (REF)			… (REF)		
$20,000 to <$35,000	0.88	0.26,3.01	.832	1.34	0.29,6.17	.704	0.09	-0.39,0.57	.713
$35,000 to <$50,000	0.97	0.26,3.63	.959	0.58	0.12,2.79	.491	-0.18	-0.58,0.21	.358
$50,000 to <$75,000	0.75	0.15,3.76	.723	2.21	0.36,13.54	.385	-0.19	-0.78,0.41	.534
$75,000 or more	0.62	0.15,2.56	.504	1.30	0.28,6.08	.734	-0.13	-0.57,0.30	.541
Ethnicity									
Non-Hispanic	1.00 (REF)			1.00 (REF)			… (REF)		
Hispanic	0.99	0.23,4.27	.985	0.37	0.05,2.69	.319	0.16	-0.25,0.56	.433
Race									
White	1.00 (REF)			1.00 (REF)			… (REF)		
Black/ African American	2.20	0.83,5.82	.110	0.46	0.10,2.07	.304	-0.10	-0.51,0.30	.604
Other	2.88	0.73,11.43	.129	3.37	0.16,73.17	.432	-0.34	-0.88,0.19	.200
Self-Affirmation	1.39	0.74,2.63	.301	2.12	1.12,4.00	.022	-0.10	-0.25,0.04	.168
Smoke-Free Policy	1.47	0.33,6.47	.605	1.37	0.33,5.63	.656	0.07	-0.32,0.46	.721

Note. Odds ratios (*OR*s) are from weighted logistic regressions predicting quit attempts (past year) and quit intentions (next six months). Unstandardized betas (*B*s) are from a weighted linear regression predicting average amount smoked per day. Predictors were entered simultaneously.

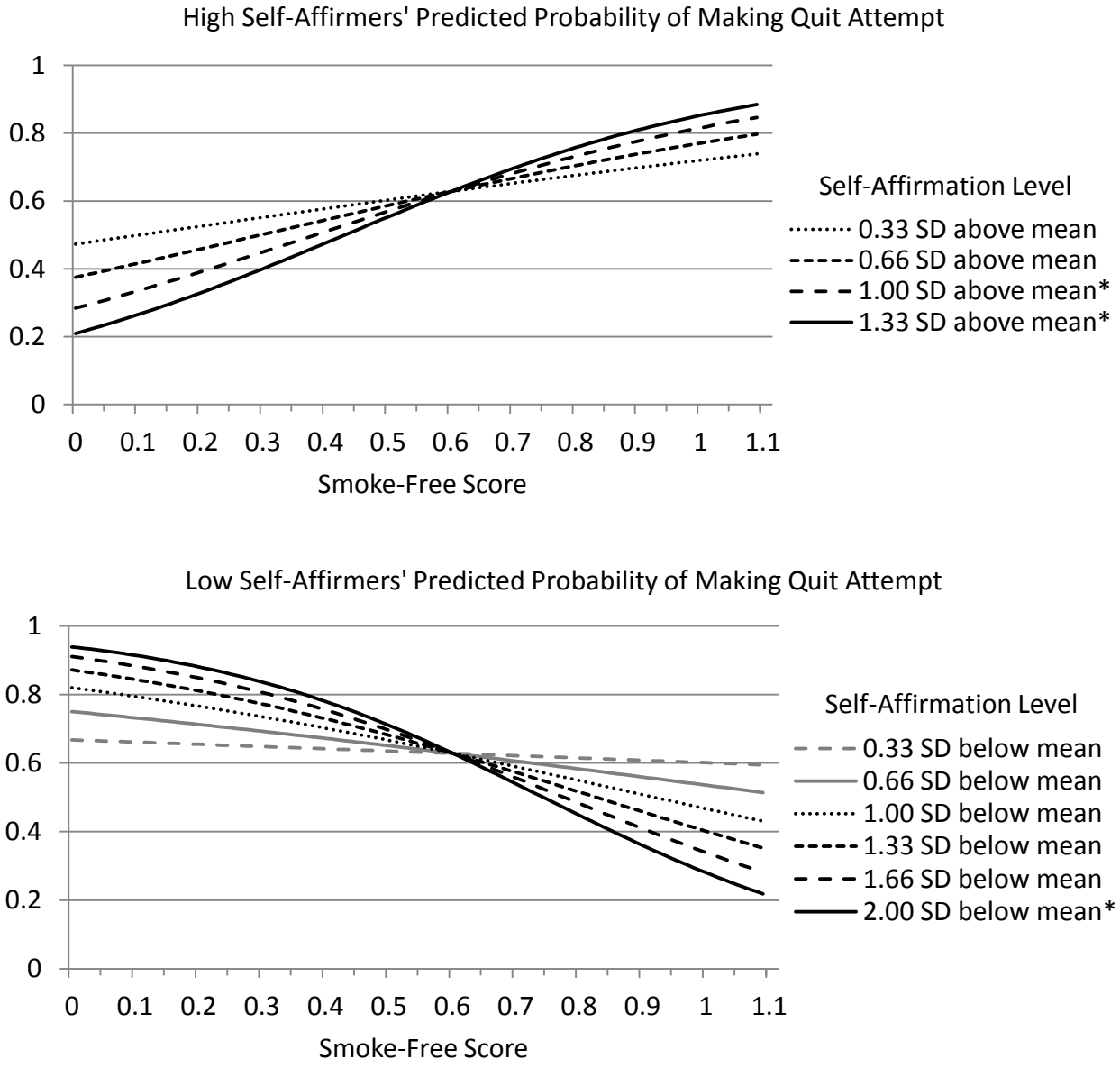

Figure 1. For high self-affirmers, the predicted probability of making a quit attempt increased as smoke-free laws became more comprehensive. For low self-affirmers, the predicted probability decreased as smoke-free laws became more comprehensive.
*: indicates the effect of smoke-free score was significant at $p < .05$

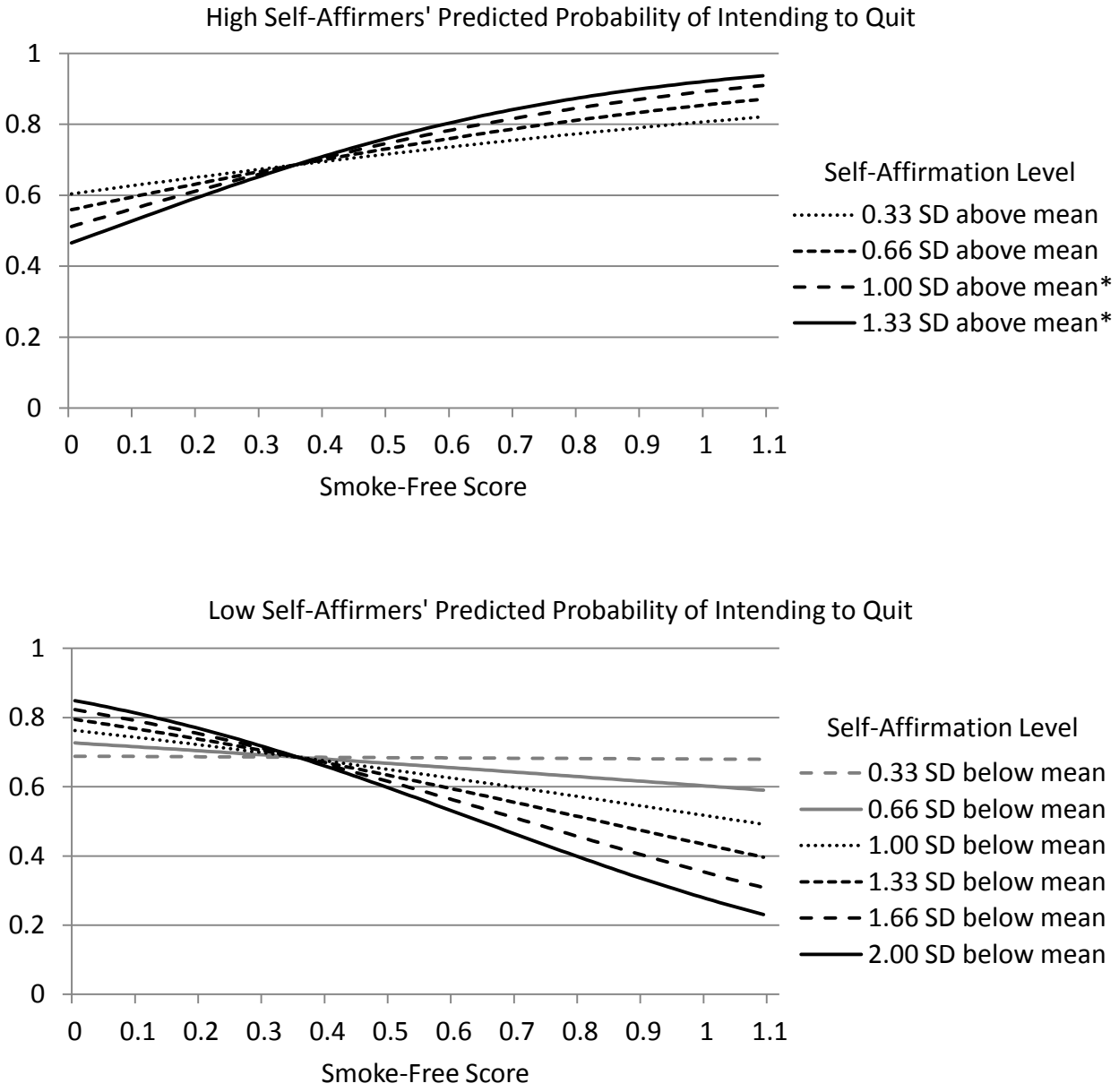

Figure 2. For high self-affirmers, the predicted probability of intending to quit increased as smoke-free laws became more comprehensive. For low self-affirmers, the predicted probability decreased as smoke-free laws became more comprehensive, but this effect did not reach significance even at very low levels of self-affirmation.
*: indicates the effect of smoke-free score was significant at $p < .05$

Smoke-free air laws and quit attempts: Evidence for a moderating role of spontaneous self-affirmation

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Abstract

Background: In addition to their primary goal of protecting nonsmokers from secondhand smoke, smoke-free air laws may also encourage intentions to quit smoking, quit attempts, and cessation among smokers. However, laws may not encourage quitting if smokers feel threatened by them and react defensively. **Objective**: This study examined whether spontaneous self-affirmation – the extent to which people think about their values or strengths when they feel threatened – may reduce smokers' reactance to smoke-free laws, enhancing the ability of the laws to encourage quitting. **Methods**: We linked state-level information on the comprehensiveness of U.S. smoke-free laws (compiled in January, 2013 by the American Lung Association) with data from a U.S. health survey (Health Information National Trends Survey) collected from September-December, 2013 (*N*=345 current smokers; 587 former smokers). **Results**: Smoke-free laws interacted with self-affirmation to predict quit attempts in the past year and intentions to quit in the next six months: Smokers higher in self-affirmation reported more quit attempts and quit intentions if they lived in states with more comprehensive smoke-free laws. There was some evidence of a "boomerang" effect (i.e., less likelihood of making a quit attempt) among smokers low in self-affirmation if living in states with more comprehensive smoke-free laws, but this effect was significant only among smokers extremely low in self-affirmation. For quit intentions, there was no evidence for a boomerang effect of smoke-free laws even among smokers extremely low in self-affirmation. More comprehensive smoke-free laws were not associated with smoking status (former vs. current smoker) or average amount smoked per day, nor did they interact with self-affirmation to predict these outcomes. **Conclusions**: The impact of smoke-free policies on quit attempts and quit intentions may be moderated by psychological characteristics such as the tendency to spontaneously self-affirm. Follow-ups should

experimentally manipulate self-affirmation and examine effects of smoke-free laws in controlled contexts.

Keywords: smoke-free, tobacco control, self-affirmation, defensive processing, reactance

Introduction

Smoke-free air laws – which ban or restrict smoking in areas such as restaurants, hotels, public transportation, and workplaces – are effective in protecting nonsmokers from secondhand smoke (Callinan, Clarke, Doherty, & Kelleher, 2010; U.S. Department of Health and Human Services, 2006). They may also reduce rates of smoking initiation among youth (Siegel, Albers, Cheng, Hamilton, & Biener, 2008). A secondary benefit of such laws is that they may influence the smoking-related attitudes, intentions, and behaviors of smokers. Specifically, smoke-free laws may reduce the social acceptability of smoking, make smoking less convenient, and reinforce the fact that tobacco smoke is harmful to health (Bernat, Erickson, Shi, Fabian, & Forster, 2010; Rayens et al., 2007). Smoke-free laws thus have the potential to encourage quit attempts, quit intentions, and quit rates among smokers (Fowkes, Stewart, Fowkes, Amos, & Praice, 2008; Hackshaw, McEwen, West, & Bauld, 2010; Nagelhout et al., 2012).

However, smoke-free laws may not necessarily increase rates of smoking cessation (Hahn, Rayens, Langley, Adkins, & Dignan, 2010). Indeed, a recent systematic review found that "the effect of smoking bans on smoking prevalence was inconclusive," with a trend toward a reduction in prevalence (Callinan et al., 2010, p. 11). The International Tobacco Control (ITC) Conceptual Model proposes that the behavioral effects of tobacco control policies will be moderated by a range of factors such as individuals' psychological characteristics (e.g., stress, time perspective) (Fong et al., 2006). Thus, there is a need for research on psychological factors that may moderate the ability of smoke-free legislation to promote cessation.

Smoke-free laws may not succeed in encouraging quitting if they evoke defensive responses or reactance among smokers. Psychological reactance is a phenomenon whereby externally imposed constraints on a particular behavior can increase people's motivation to

engage in the behavior in an attempt to restore feelings of personal freedom (Brehm, 1966). For example, a law raising the legal drinking age may increase alcohol consumption among drinkers who are newly "underage" if they perceive a reduction in their freedom (Allen, Sprenkel, & Vitale, 1994). Reactance has been documented in response to health warnings against risky behaviors such as alcohol use (Richards & Banas, 2014) and smoking (Freeman, Hennessy, & Marzullo, 2001; Rhodes, Roskos-Ewoldsen, Edison, & Bradford, 2008). People exhibit greater reactance when they perceive less ability to choose their own actions (Miller, Lane, Deatrick, Young, & Potts, 2007). Other defensive reactions such as derogating risk information and downplaying personal vulnerability can also occur in response to communications about health threats (Harris, Mayle, Mabbott, & Napper, 2007; Erceg-Hurn & Steed, 2011; McQueen, Vernon, & Swank, 2012; Schüz, Schüz, & Eid, 2013). It may benefit public health to understand and, if possible, to avoid such "boomerang" effects in the implementation of smoke-free laws.

An important psychological construct that has been shown to reduce defensive reactions to threatening information is self-affirmation. Self-Affirmation Theory (Steele, 1988) holds that individuals seek to maintain perceptions of self-integrity – that is, views of themselves as competent, consistent, and moral individuals. When self-integrity is threatened – e.g., by the suggestion that one's behavior is unhealthy, or by a policy prohibiting the expression of some aspect of one's identity (such as smoking) – people may process the information defensively to protect their self-integrity. For example, in one study, smokers who viewed smoking as an important part of their identity responded more defensively to antismoking videos (Freeman et al., 2001). *Self-affirmation* is a process by which people can bolster their self-integrity by reflecting on their values or strengths, which can allow them to face threats to self-integrity without reacting defensively (Cohen & Sherman, 2014). Self-affirmation has been shown to

enhance people's attention to health messages, perceptions of risk, intentions to engage in protective behaviors, and behavior change (Cohen & Sherman, 2014). In the domain of smoking, self-affirmation can reduce defensive responding to warning labels, increase acceptance of anti-smoking messages, and promote quit intentions (Armitage, Harris, Hepton, & Napper, 2008; Harris et al., 2007). Given these effects, it may also mitigate the potential self-threat associated with smoke-free laws.

Self-affirmation can be induced by asking people to reflect on an important value and how they adhere to it in everyday life (McQueen & Klein, 2006). However, people may also spontaneously engage in activities to self-affirm, particularly when experiencing psychological threats (e.g., by writing about life events, viewing social media, or consuming certain goods; Creswell et al., 2007; Sivanathan & Pettit, 2010; Toma & Hancock, 2013; Townsend & Sood, 2012). Indeed, recent studies have assessed individual differences in the tendency to self-affirm when under threat (Harris, Napper, Griffin, Schüz, & Stride, 2014; Pietersma & Dijkstra, 2012, Taber et al., 2015c), and research shows that self-affirming can offset defensiveness even after a threat has been encountered (Briñol, Petty, Gallardo, & DeMarree, 2007). Spontaneous self-affirmation thus holds promise for reducing defensiveness to potential self-threats from smoke-free policies.

Although no studies to our knowledge have directly tested whether self-affirmation can reduce psychological reactance to policies that restrict certain behaviors, it should be noted that the perception that one is free to make choices is central to self-integrity (Steele, 1988). Self-affirmation may thus reduce the motivation to assert one's freedom in response to restrictions on behavior. Accordingly, self-affirmation may moderate the behavioral effects of smoke-free laws, which directly limit smoking in certain places (Bernat et al., 2010) in addition to implicitly

conveying information about the harms and undesirability of smoking (Rayens et al., 2007). The current study assessed this possibility by exploring whether spontaneous self-affirmation moderated the association between smoke-free laws and smoking-related behaviors and intentions (current smoking, quit attempts, quit intentions, and amount smoked). This study will add to the current literature by examining the role of self-affirmation with respect to policy (an association rarely examined previously) using data from a national survey. If self-affirmation moderates the effects of smoke-free laws on smoking behavior, then it may have intervention implications; for example, it may be possible to design affirmation-based interventions to accompany the implementation of smoke-free laws.

Methods

Data Sources

Data on smoking behavior, spontaneous self-affirmation, and demographic variables were gathered from the National Cancer Institute's Health Information National Trends Survey (HINTS) 4 Cycle 3. This nationally representative, cross-sectional mail survey assessed cancer information seeking and health behaviors such as smoking, diet, and exercise. HINTS data were collected between September and December of 2013. U.S. households were selected using a random sample of U.S. addresses; within each household, one adult was selected based on proximity of birth date to survey date. A complex sampling design was employed and high minority areas were oversampled. Sample weights were employed to account for the complex sampling design, as well as for household nonresponse, and are used to calculate appropriate standard errors for statistical procedures and to generate nationally representative estimates.

The overall weighted response rate for HINTS 4 Cycle 3 was 35.2%, which is consistent with other mailed surveys (Dillman, 2000). Of the 12,010 households selected to receive a

mailing, there were 79 refusals, 7134 nonresponses, and 1612 mailings returned as undeliverable (Westat, 2014). In total, 3185 individuals returned surveys that were either "complete" (n = 3124), meaning that at least 80% of required questions had been answered in the first two sections of the survey, or "partially complete" (n = 61), meaning that between 50 and 79% of the required questions were answered (Westat, 2014, p. 14). On the variables assessed here, the extent of missing data on each of the items was: gender (n = 82, 2.6%), age (n = 103, 3.2%), education (n = 89, 2.8%), income (n = 446, 14.0%), race/ethnicity (n = 460, 14.4%), self-affirmation variables (n = 186, 5.8%; and n = 193, 6.0%), and smoking variables: smoked 100 cigarettes (n = 22, 0.6%), currently smoking every day, some days, or not at all (n = 23, 1.6%), average amount smoked daily (n = 4; 0.8%), seriously considering quitting smoking (n = 5, 1.0%), and quit attempts in the past year (n = 5, 1.0%). We examined data only from a subsample of 932 current or former smokers with data on all demographic variables, self-affirmation, and – among current smokers – quit attempts, quit intentions, and average amount smoked per day. This subsample included respondents from all U.S. states and Washington, DC, with the exception of Alaska, Idaho, North Dakota, South Dakota, and Vermont. Further details of the survey are available at: http://hints.cancer.gov/instrument.aspx. Federal Information Processing Standard (FIPS) state codes (http://www.epa.gov/envirofw/html/codes/state.html) were used to link these data with state-level data on smoke-free air laws.

Data on smoke-free air laws were gathered from the American Lung Association's (ALA) 2013 evaluation of the comprehensiveness of U.S. states' smoke-free laws (ALA, 2013). These data were based on policies that were in effect as of January 2, 2013. The scoring system for smoke-free air laws was based on criteria developed by an expert panel convened by the National Cancer Institute and presented in Chriqui et al. (2002). The overall score for each state

reflects the comprehensiveness of its smoke-free laws in eleven categories, including restaurants, retail stores, bars, casinos and gambling establishments (in states where gambling is legal), schools, child care facilities, recreational and cultural facilities, government workplaces, private workplaces, penalties, and enforcement. States could be awarded up to four points in each category. Bonus points were also available in some categories. For example, for private workplaces, "A bonus point (+1) was available if the laws met the target criteria and required the grounds or a specified distance from entries or exits to be smokefree" (ALA, 2013, p. 44). Smoke-free air scores were computed by the ALA as the sum of points across all categories and could reach a maximum score of 44 (for states that allow casinos) or 40 (for states that do not allow casinos). Each state's score was converted to the fraction of the total points possible for that state.

To assess the novelty of the smoke-free laws, we examined the change in scores between the 2012 and 2013 ALA reports, finding that the scores of only 2 states (Indiana and North Dakota) changed between these years, with an overall Pearson correlation of 0.94 between 2012 and 2013 scores. From 2011 to 2012, the scores were also highly stable, with very slight changes in the scores of only five states and a Pearson r of 0.999. This suggests that almost all of the laws were in effect for multiple years before our assessments of smoking behavior and intentions.

Measures

Spontaneous self-affirmation was assessed by asking respondents to agree or disagree with two statements on a 4-point scale from 1 (*Strongly disagree*) to 4 (*Strongly agree*): "When I feel threatened or anxious I find myself thinking about my strengths," and "When I feel threatened or anxious I find myself thinking about my values." Responses to these items were averaged to create a composite measure of self-affirmation tendency (Cronbach's alpha = 0.83).

These items were selected for inclusion on the HINTS survey from the full scale (Harris et al., 2015). Both items correlate well with the full scale, which predicts scores on various published indices of self-affirmation (e.g., Napper, Harris & Epton, 2009; Pietersma & Dijkstra, 2012; Sherman, Nelson & Steele, 2000). Analyses conducted using either of the two items alone led to results that were similar to those found using the composite measure. Cronbach's alpha was calculated using unweighted data. Of note, the self-affirmation items in this HINTS dataset have been used elsewhere to examine the association of self-affirmation with well-being (Emanuel et al., 2015), with aspects of the health care experience and information seeking (Taber et al., 2015a), and with indicators of physical, mental, and cognitive health and information seeking among cancer survivors (Taber et al., 2015b).

Smoking status was determined using two questions (Centers for Disease Control and Prevention, 2014). Current smokers were defined as those who reported smoking at least 100 cigarettes in their entire lives and currently smoking "Everyday" or "Some days." Former smokers were defined as those who reported smoking at least 100 cigarettes in their entire lives and currently smoking "Not at all." Current smokers were asked three follow-up questions about their smoking behavior: At any time in the past year, have you stopped smoking for one day or longer because you were trying to quit? (*Yes/ No*), Are you seriously considering quitting smoking in the next six months? (*Yes/ No*), and On the average, when you smoked during the past 30 days, about how many cigarettes did you smoke a day? (5 categories: *1-10, 11-19, 20, 21-39, 40+*) To reduce skew, responses to the last item were re-coded into a 3-category scale (*1-10, 11-19, 20+*), although analyses conducted without recoding this variable led to results consistent with the reported findings.

Demographic characteristics were also assessed. Respondents reported their gender, age, highest level of education, annual household income, race, and ethnicity. All analyses controlled for these factors.

Statistical Analyses

Weighted hierarchical regressions tested whether smoke-free laws, self-affirmation, and their interaction were associated with smoking behavior, including current smoking status (current vs. former), making quit attempts, quit intentions, and current amount smoked. In the first step of each regression, we entered demographic characteristics, smoke-free score, and self-affirmation scores. In the second step, we added the interaction between smoke-free score and self-affirmation. The regressions were logistic for analyses of the dichotomous variables (smoking status, quit attempts and quit intentions), and linear for amount smoked. The analytic sample for analyses of quit attempts, quit intentions, and amount smoked included respondents who were current smokers and had valid data on all demographic variables, quit attempts, quit intentions, and average amount smoked per day. The analysis of smoking status used an expanded sample that also included former smokers. No imputation strategy was used to replace missing data. To account for the complex sampling design of HINTS, a set of 50 jackknife replicate weights were used in all analyses, as is recommended for analyses of these data (Westat, 2014). Analyses were conducted using SAS-callable SUDAAN version 11.0.0 (RTI, Research Triangle Park, NC).

Results

Demographics and Smoking Status

Table 1 shows the demographic characteristics of current (n = 345) and former (n = 587) smokers. The analytic sample included respondents with a wide range of demographic

characteristics. Smoke-free scores ranged from 0 to 1.09, with a mean of 0.79, a standard deviation (based on unweighted data) of 0.29, and a Fisher-Pearson coefficient of skewness (Doane & Seward, 2011) of -1.19, indicating a negative skew. Self-affirmation scores ranged from 1 to 4 with a mean of 2.69 (2.75 among current smokers only), and an SD (unweighted) of 0.85 (0.84 among current smokers only).

As shown in Table 1, a weighted logistic regression found that older respondents were less likely than the youngest respondents to be current rather than former smokers. Less educated respondents were more likely to be current smokers, as were blacks compared to whites. Respondents scoring higher on the self-affirmation index were more likely to be current rather than former smokers. There was no significant association between smoking status and state smoke-free score. When the interaction term (self-affirmation x smoke-free score) was added to the model, there was no evidence of an interaction (*OR* = 1.08, *95% CI:* 0.33-3.49, *p* = .898) with smoking status as the dependent variable.

[Table 1]

Quit Attempts, Quit Intentions, and Amount Smoked

Table 2 shows the distribution of quit attempts, quit intentions, and amount smoked among current smokers. Table 3 displays associations of these variables with sociodemographic factors, spontaneous self-affirmation, and smoke-free scores. Older respondents were less likely than the youngest respondents to make quit attempts and tended to smoke more cigarettes on average. Respondents who scored higher on the self-affirmation index were more likely to intend to quit smoking, but self-affirmation was not associated with quit attempts or amount smoked. There was no main effect of smoke-free air laws on quit attempts, quit intentions, or amount smoked.

[Table 2]

[Table 3]

When the interaction term (self-affirmation x smoke-free score) was added to each model, significant interactions emerged for quit attempts (*OR* = 11.35, *95% CI:* 1.41-91.53, *p* = .024) and quit intentions (*OR* = 6.68, *95% CI:* 1.11-40.13, *p* = .038) but not for amount smoked (*B* = -0.12, *95% CI:* -0.74-0.50, *p* = .702). Simple slopes analyses were conducted to explore the significant interactions for quit attempts and quit intentions (Aiken & West, 1991). Specifically, we reran each full regression model after centering self-affirmation at different values and recalculating the interaction term. This allowed us to examine the association between smoke-free legislation and quit attempts and quit intentions at high and low levels of self-affirmation (Aiken & West, 1991). In particular, we reran the full regression model 10 times, including with self-affirmation centered at six values below its mean (0.33, 0.66, 1.00, 1.33, 1.66, and 2.00 standard deviations (SDs) below the mean) and at four values above its mean (0.33, 0.66, 1.00, and 1.33 SDs above the mean). We did not examine 1.66 or 2.00 SDs above the mean because these values of self-affirmation (4.14 and 4.42) would exceed the top of the self-affirmation scale, which ranged from 1 to 4.

Consistent with predictions, among smokers high in self-affirmation, those living in locations with more comprehensive smoke-free air laws reported more quit attempts. This effect was not significant when self-affirmation was only 0.33 SDs above the mean (3.03; *OR* = 2.86, *95% CI*: 0.67-12.08, *p* = .150), but approached significance at 0.66 SDs above the mean (3.30; *OR* = 5.58, *95% CI*: 0.94-33.01, *p* = .058) and was significant at 1.00 SD above the mean (3.59; *OR* = 11.12, *95% CI*: 1.20-103.28, *p* = .035) or higher. For example, when self-affirmation was 1 SD above the mean, an increase in smoke-free score from 0.54 (the middle of the range of

smoke-free scores) to 1.09 (the highest smoke-free score) was associated with an increase in predicted probability of making a quit attempt from 0.59 to 0.85.

On the other hand, among smokers low in self-affirmation, higher smoke-free scores were associated with a lower likelihood of making a quit attempt. This effect did not approach statistical significance until self-affirmation was very low, 1.66 SDs below the mean (1.36; *OR* = 0.05, *95% CI*: 0.00-1.12, *p* = .058), and did not achieve significance until even lower, 2.00 SDs below the mean (1.08; *OR* = 0.03, *95% CI*: 0.00-0.97, *p* = .048). Figure 1 shows the predicted probabilities of making a quit attempt depending on smoke-free score and level of self-affirmation.

[Figure 1]

A similar pattern emerged for quit intentions in the next six months. For smokers higher than average in self-affirmation, there was a positive association between smoke-free laws and intentions to quit smoking that did not reach significance at 0.66 SDs above the mean of self-affirmation (3.30; *OR* = 4.62, *95% CI*: 0.87-24.61, *p* = .072) but attained significance at 1.00 SD above the mean (3.59; *OR* = 7.92, *95% CI*: 1.03-60.61, *p* = .047). For smokers lower than average in self-affirmation, the association between smoke-free score and quit intentions did not reach statistical significance even at 2 SDs below the mean for self-affirmation (1.08; *OR* = 0.07, *95% CI*: 0.00-1.65, *p* = .097). Figure 2 displays predicted probabilities of intending to quit depending on smoke-free scores and self-affirmation. For example, when self-affirmation was 1 SD above the mean (3.59 on a 4-point scale), an increase in smoke-free score from the midpoint of the range (0.54) to the top of the range (1.09) was associated with an increase in predicted probability of intending to quit from 0.76 to 0.91.

[Figure 2]

Supplementary Analyses

A series of follow-up analyses was conducted to test the robustness and sensitivity of the results concerning the interactions between smoke-free scores and self-affirmation. First, we tested the potential influence of outliers on the results. Respondents scoring greater than 2 SDs below the mean on the self-affirmation measure were recoded to the closest score within 2 SDs of the mean; 24 current smokers and 60 former smokers scoring a 1 were recoded to a 1.5 (no respondents scored greater than 2 SDs above the mean as this value was beyond the range of the scale). Analyses using this capped measure of self-affirmation led to results that were identical to those reported above in terms of direction and significance. Similarly, respondents from states with very high or very low smoke-free scores (outside 2 SDs from the mean) were recoded to the closest score within 2 SDs of the mean; 8 current smokers and 17 former smokers were recoded from 0-0.16 to 0.20. Again, the pattern and significance of results using this capped measure of smoke-free score replicated those from the analyses reported above.

An additional follow-up analysis tested the robustness of the results to variations in the coding of smoke-free scores. In the analyses reported above, smoke-free score was treated as a continuous variable (0-1.09), and, as noted, there was a negative skew (-1.19) in the distribution. In a follow-up analysis, we re-coded smoke-free scores into three categories of roughly equal size: 0-0.77 (121 smokers; 144 former smokers), 0.78-0.93 (124 smokers; 259 former smokers), and 0.94-1.09 (100 smokers; 184 former smokers). This categorical variable had very little skew, -0.03. Results using this categorical variable were similar, though not identical, to those reported earlier. There was a significant interaction between smoke-free score and self-affirmation in predicting quit attempts (*OR* = 2.29, *95% CI*: 1.05-4.97, $p = .037$). The interaction between smoke-free score and self-affirmation approached but did not reach significance in predicting

quit intentions (*OR* = 1.97, *95% CI*: 0.97-4.03, *p* = .061). As previously, smoke-free score and self-affirmation did not interact in predicting amount smoked (*B* = -0.16, *95% CI*: -0.36-0.05, *p* = .130) or current smoking status (current vs. former; *OR* = 0.95, *95% CI*: 0.60-1.52, *p* = .842).

An alternative method of categorizing smoke-free scores was also examined: specifically, the range of smoke-free scores was divided into three roughly equal ranges: low (0-0.36; 80 smokers; 94 former smokers), medium (0.37-0.71; 19 smokers; 27 former smokers), and high (0.72-1.09; 246 smokers; 466 former smokers). This categorical variable was somewhat more negatively skewed than the original continuous variable (-1.41 vs. -1.19). Using this rough categorization, smoke-free score marginally interacted with self-affirmation to predict quit attempts (*OR* = 2.06, *95% CI*: 0.99-4.30, *p* = .053), but not quit intentions (*OR* = 1.69, *95% CI*: 0.88-3.24, *p* = .112), amount smoked (*B* = -0.05, *95% CI*: -0.26-0.15, *p* = .615), or smoking status (*OR* = 1.09, *95% CI*: 0.67-1.76, *p* = .730).

We note that dividing a continuous scale into discrete categories using either of the methods used in these supplementary analyses requires drawing potentially arbitrary distinctions among scores. This can result in lost information and reduced statistical power. However, when presented in conjunction with the results using the original continuous variable, such analyses may provide additional information about the robustness of effects.

Discussion

The present study found evidence that spontaneous self-affirmation may moderate the association between the comprehensiveness of state-level smoke-free laws and quit attempts and quit intentions. Current smokers who were higher in self-affirmation were more likely to report making a quit attempt and intending to quit when living in locations with more comprehensive smoke-free air laws, suggesting that smoke-free laws may encourage cessation among these

individuals. This may be a significant secondary benefit of smoke-free laws, in addition to their primary purpose of protecting nonsmokers from exposure to secondhand smoke (Callinan et al., 2010; U.S. Department of Health and Human Services, 2006). Indeed, a recent study found that smokers who expressed support for restricting smoking in public venues were more likely to quit smoking in the next year (Nagelhout, Zhuang, Gamst, & Zhu, 2015). Future research might examine whether spontaneous self-affirmation mediates this association; specifically, smokers higher versus lower in spontaneous self-affirmation may be more supportive of smoke-free laws, as they may see these laws as a tool to help them quit smoking.

In contrast, among smokers who were lower in self-affirmation, there was some evidence of an ironic effect of smoke-free laws on quit attempts (i.e., reduced likelihood of making a quit attempt among those living in states with stronger smoke-free laws). This is consistent with the phenomenon of psychological reactance, in which externally imposed constraints on a behavior can increase people's motivation to engage in the behavior in order to restore feelings of personal freedom (Brehm, 1966; Allen et al., 1994). However, this effect did not appear to be as strong as the positive effect observed among high self-affirmers, as it only reached statistical significance among those extremely low in self-affirmation (2 SDs below the mean). Moreover, the negative association between smoke-free laws and quit *intentions* did not reach statistical significance even among those extremely low in self-affirmation (2 SDs below the mean). Nevertheless, these findings raise the possibility that self-affirmation characteristics may moderate smokers' responses to smoke-free policies.

Among our other two outcome measures – current smoking status and amount smoked per day – we found no moderated or overall associations with the comprehensiveness of state smoke-free air laws. A post hoc explanation for this finding is that smoke-free air laws increase

current smokers' desire to quit but have smaller effects on sustained behavior (smoking status and amount smoked) because of the addictiveness of tobacco. It is well known that smoking cessation often requires many quit attempts (Zhou et al., 2008), and, although the motivation to quit is sufficient to prompt quit attempts, it does not ensure the maintenance of cessation (Borland et al., 2010). Over time, increased quit attempts may translate into effects on current smoking status. Some studies have indeed found effects of smoke-free laws on smoking prevalence and amount smoked, though the effects have been limited (Callinan et al., 2010; Schillo et al., 2012). However, the relationship between state policies and smoking behavior may be diluted by other factors in the environment, such as local smoke-free ordinances, or at the individual level. Also, our statistical power to detect associations between smoke-free laws and smoking behavior was limited by the study's modest sample size. Thus, continued research using different types of moderators (e.g., strength of nicotine dependence) and larger sample sizes is needed to further explore the impact of smoke-free laws on these outcomes.

One unexpected result of this study was the finding that respondents scoring higher on the self-affirmation index were more likely to be current rather than former smokers. This result runs counter to studies finding positive effects of self-affirmation on processing of health information and engagement in health protective behaviors (Armitage, Harris, & Arden, 2011; Cohen & Sherman, 2014; Epton, Harris, Kane, van Koningsbruggen, & Sheeran, 2015). However, the majority of these prior findings involved experimental inductions of self-affirmation, and much less is known about demographic or health behavior correlates of spontaneously affirming in response to threat in everyday life (Harris et al., 2015). One unpublished study using the larger HINTS sample from which the current study was taken demonstrated that self-affirmation tendencies are higher in older individuals and black and

Hispanic compared to white adults (Emanuel et al., 2015). However, it is unknown to what extent threatening circumstances may promote self-affirmation as a strategy to cope. Also, it is worth noting that, although self-affirmation typically increases openness to health information, "whether the moment of openness then prompts enduring changes in behavior … hinges on other factors" (Cohen & Sherman, 2014, p. 348). In particular, there are considerable barriers to long-term behavior change in smoking, such as strong cravings and the need to avoid "high-risk" situations (i.e., those that provoke cravings) that could lead to a relapse (Sayette, Loewenstein, Griffin, & Black, 2008). Finally, it is also possible that the association between self-affirmation and current smoking observed here was a recruitment effect: Current smokers may have been more reluctant than former smokers to take part in a health survey, and self-affirmation may have moderated this tendency with the result that people higher in self-affirmation were over-represented among current smokers. Clearly, more evidence is needed concerning the association between self-affirmation and smoking status, as well as other factors that may moderate this association.

Limitations

This study's cross-sectional design prohibits the determination of causality. Our aim is to stimulate further social psychological and communication research on smoke-free laws and other areas of tobacco control, as psychologists and communication scientists have much to add in terms of maximizing the potency, targeting, and effectiveness of tobacco policies (Strahan et al., 2002; Klein, Shepperd, Suls, Rothman, & Croyle, 2014). A second limitation is that smoking-related behaviors were self-reported. However, outside of subpopulations such as pregnant women and underage youth, research has found no evidence that self-reports of quit attempts and smoking status are biased by social desirability concerns (Patrick et al., 1994; Persoskie &

Nelson, 2013; Yeager & Krosnick, 2010). A third limitation is that our analyses focused on state-level policies (ALA, 2013). Variation in smoke-free policies also exists within individual states (e.g., at the city and county levels), and future studies should extend the present results by examining the effects of policy variations at more granular levels. We see particular value in studies assessing smokers' behavior before and after the implementation of smoke-free policies in specific settings such as workplaces. Such studies avoid an additional limitation of the present research, which is that we could not assess the extent to which respondents were affected by the laws (e.g., some respondents may have spent more time in their own homes than did others). Finally, this study was conducted with a relatively modest sample size. Conclusions about the overall effects of smoke-free laws on quitting behavior should be derived from much larger studies, systematic reviews, and meta-analyses (Callinan et al., 2010).

Implications

Our results point to several intriguing possibilities concerning the effects of smoke-free laws on quit attempts, all requiring further empirical investigation. Research has examined personality traits such as sensation seeking and trait reactance as factors that may *increase* reactance (Quick & Stephenson, 2008), but less work has examined individual differences that may *reduce* reactance. Because self-affirmation can be induced, the present data have important implications. Smoke-free laws may be more effective in encouraging quit attempts among people who spontaneously self-affirm when under threat, compared to those who do not. For people who do not spontaneously self-affirm, it may be possible to encourage self-affirmation by informing people about smoke-free laws on social media, where the viewing of one's online profile tends to act as a self-affirmation (Toma & Hancock, 2013; Toma, 2010). Simply asking people to reflect on their values and strengths, to think about times when they have been kind to

others, or to generate a plan to self-affirm when threatened have also been shown to reduce defensiveness and encourage adoption of healthy behaviors (Epton et al., in press; Armitage et al., 2011; Reed & Aspinwall, 1998; see Cohen & Sherman, 2014; McQueen & Klein, 2006). It may be possible to incorporate self-affirmation techniques into the implementation of new smoke-free laws – for example, through a media campaign timed to coincide with the implementation of the new law (McGoldrick & Boonn, 2010). Such techniques may maximize the public health benefits of smoke-free laws if they reduce smokers' psychological reactance and encourage cessation, without compromising the laws' primary aim of protecting nonsmokers. Of note, the implications may also extend to understanding reactance in the context of other health messages or laws that may imply constraints on behavior, such as restrictions on the use of electronic cigarettes in public places (World Health Organization, 2014).

Research is also needed to address several additional questions raised by the present findings. First, what are the mechanisms underlying the moderating effects of self-affirmation observed here? There are several psychological processes upon which self-affirmation may act, such as defensiveness toward changes in smoking norms, reactance to perceived restriction on the freedom to smoke, and defensive processing of the health risk implications of smoke-free laws (Cohen & Sherman, 2014). Research also indicates that self-affirmation can reduce ironic effects associated with thought-suppression (Koole & van Knippenberg, 2007) and can enhance self-control (Schmeichel & Vohs, 2009) and psychological resources (Shea & Masicampo, 2014), which suggests it may be a means of avoiding pro-smoking thoughts or cravings that arise when smokers encounter a smoke-free policy (Earp, Dill, Harris, Ackerman, & Bargh, 2013), or may increase resources to cope with them. Further, reactance may take the form of anger or negative

cognitions (Dillard & Shen, 2005). Future research should test the psychological mechanisms by which smoke-free laws influence cessation and how self-affirmation acts on these processes.

Second, other methods of reducing smokers' potential defensiveness toward smoke-free laws, aside from self-affirmation, should be explored. For example, there are many ways to alert the public and enforce smoke-free legislation (e.g., imposing a fine; posting signage about the harms of secondhand smoke), some of which may be more or less psychologically threatening than others. Other strategies, such as "restoration" or "inoculation" messages that somehow indicate freedom of choice have been shown to reduce reactance in other settings (Albarracin, Durantini, Earl, Gunnoe, & Leeper, 2008; Miller et al., 2007; Richards & Banas, 2014) and could be employed in signs denoting smoke-free environments. Valuable insights may also emerge from understanding the mechanisms underlying the increased public support for smoke-free laws that tends to occur over time, including among smokers, following their implementation (U.S. Department of Health and Human Services, 2006). Finally, it may be especially productive to study defensiveness to smoke-free policies in particular locations that may evoke threat – for example, in multiunit housing, given that "private homes have long been considered spaces beyond the legitimate reach of regulation" (Winickoff, Gottlieb, & Mello, 2010, p. 2319; see also Wilson, Klein, Blumkin, Gottlieb, & Winickoff, 2011).

Conclusion

The impact of smoke-free policies on quit attempts and quit intentions may be moderated by psychological characteristics such as the tendency to spontaneously self-affirm. Thus, it may be possible to improve the implementation of smoke-free laws and other policies encouraging healthy behaviors by using self-affirmation techniques (Ehret & Sherman, in press). However,

follow-up studies are needed in which self-affirmation is experimentally manipulated and the effects of smoke-free laws are observed in a pre-post design.

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Table 1
Demographic characteristics and weighted associations with current smoking status

	Current Smokers		Former Smokers				
Characteristic	*n* or mean	%	*n* or mean	%	*OR*	*95% CI*	*p*
N	345	100.0	587	100.0			
Gender							
Female	194	45.9	283	38.6	1.00 (REF)		
Male	151	54.1	304	61.4	0.69	0.39-1.21	.186
Age							
18-34	64	34.5	60	22.3	1.00 (REF)		
35-49	102	38.1	95	25.4	0.93	0.40-2.14	.857
50-64	128	21.3	208	28.0	0.42	0.19-0.91	.029
>64	51	6.1	224	24.4	0.11	0.04-0.27	<.001
Education							
≤ Some High School	45	12.0	33	3.1	7.64	2.35-24.78	.001
High School Graduate	146	47.7	158	27.3	5.57	2.83-10.97	<.001
Some College	86	23.4	142	31.6	1.83	0.80-4.18	.147
College Graduate	68	16.8	254	38.0	1.00 (REF)		
Household Income ($)							
<$20,000	139	26.8	110	15.3	1.00 (REF)		
$20,000 to <$35,000	56	16.0	83	12.1	1.05	0.40-2.76	.915
$35,000 to <$50,000	52	16.9	97	18.0	0.64	0.31-1.33	.226
$50,000 to <$75,000	40	13.0	112	19.1	0.58	0.27-1.22	.145
$75,000 or more	58	27.3	185	35.6	0.81	0.38-1.74	.589
Ethnicity							
Non-Hispanic	303	89.4	514	90.8	1.00 (REF)		
Hispanic	42	10.6	73	9.2	0.99	0.39-2.48	.980
Race							
White	242	77.7	486	88.3	1.00 (REF)		
Black/ African American	65	13.4	59	5.5	3.00	1.27-7.07	.013
Other	38	8.9	42	6.3	1.58	0.58-4.34	.364
Self-Affirmation	2.75		2.64		1.44	1.03-2.01	.034
Smoke-Free Air Score	0.77		0.81		0.95	0.33-2.69	.918

Note. Values reflect unweighted counts (*n*), weighted percentages (%), and means. Odds ratios (*OR*s) are from a weighted logistic regression predicting current smoking status (1 = current smoker; 0 = former smoker) in which predictors were entered simultaneously.

Table 2
Quit attempts, quit intentions, and amount smoked

Behavior or intention	*n* (%)
N	345 (100)
Made a Quit Attempt in Past Year[a]	
No	131 (38.1)
Yes	214 (61.9)
Considering Quitting in Next 6 Months[a]	
No	102 (31.5)
Yes	243 (68.5)
Average Cigarettes Smoked per Day	
1-10	194 (58.0)
11-19	66 (21.9)
20[b]	40 (7.5)
21-39[b]	32 (9.8)
40+[b]	13 (2.8)

Note. Unweighted *n*s and weighted %s.
[a] There was moderate overlap in these two variables. 43.5% of respondents who did not make a quit attempt in the past year were seriously considering quitting in the next 6 months. 86.9% of those who made a quit attempt in the past year were seriously considering quitting in the next 6 months.
[b] These responses were collapsed into a single category (20+) in the analysis of amount smoked reported here.

Table 3
Weighted associations with quit attempts, quit intentions, and amount smoked

	Quit Attempt			Quit Intentions			Amount Smoked		
Characteristic	*OR*	*95% CI*	*p*	*OR*	*95% CI*	*p*	*B*	*95% CI*	*p*
Gender									
Female	1.00 (REF)			1.00 (REF)			… (REF)		
Male	1.21	0.50,2.92	.663	0.85	0.34,2.11	.715	0.16	-0.11,0.44	.243
Age									
18-34	1.00 (REF)			1.00 (REF)			… (REF)		
35-49	0.61	0.19,1.92	.387	0.54	0.13,2.19	.381	0.25	-0.12,0.62	.183
50-64	0.34	0.13,0.92	.034	0.35	0.09,1.30	.113	0.37	-0.08,0.81	.106
>64	0.35	0.10,1.23	.098	0.33	0.07,1.60	.164	0.59	0.19,0.99	.005
Education									
≤ Some High School	1.86	0.35,9.88	.459	1.39	0.24,8.11	.709	0.36	-0.37,1.10	.326
High School Graduate	1.00	0.38,2.65	.997	0.44	0.12,1.59	.205	0.26	-0.05,0.57	.098
Some College	0.73	0.20,2.65	.631	1.09	0.25,4.81	.909	0.12	-0.24,0.48	.500
College Graduate	1.00 (REF)			1.00 (REF)			… (REF)		
Household Income ($)									
<$20,000 (REF)	1.00 (REF)			1.00 (REF)			… (REF)		
$20,000 to <$35,000	0.88	0.26,3.01	.832	1.34	0.29,6.17	.704	0.09	-0.39,0.57	.713
$35,000 to <$50,000	0.97	0.26,3.63	.959	0.58	0.12,2.79	.491	-0.18	-0.58,0.21	.358
$50,000 to <$75,000	0.75	0.15,3.76	.723	2.21	0.36,13.54	.385	-0.19	-0.78,0.41	.534
$75,000 or more	0.62	0.15,2.56	.504	1.30	0.28,6.08	.734	-0.13	-0.57,0.30	.541
Ethnicity									
Non-Hispanic	1.00 (REF)			1.00 (REF)			… (REF)		
Hispanic	0.99	0.23,4.27	.985	0.37	0.05,2.69	.319	0.16	-0.25,0.56	.433
Race									
White	1.00 (REF)			1.00 (REF)			… (REF)		
Black/ African American	2.20	0.83,5.82	.110	0.46	0.10,2.07	.304	-0.10	-0.51,0.30	.604
Other	2.88	0.73,11.43	.129	3.37	0.16,73.17	.432	-0.34	-0.88,0.19	.200
Self-Affirmation	1.39	0.74,2.63	.301	2.12	1.12,4.00	.022	-0.10	-0.25,0.04	.168
Smoke-Free Policy	1.47	0.33,6.47	.605	1.37	0.33,5.63	.656	0.07	-0.32,0.46	.721

Note. Odds ratios (*OR*s) are from weighted logistic regressions predicting quit attempts (past year) and quit intentions (next six months). Unstandardized betas (*B*s) are from a weighted linear regression predicting average amount smoked per day. Predictors were entered simultaneously.

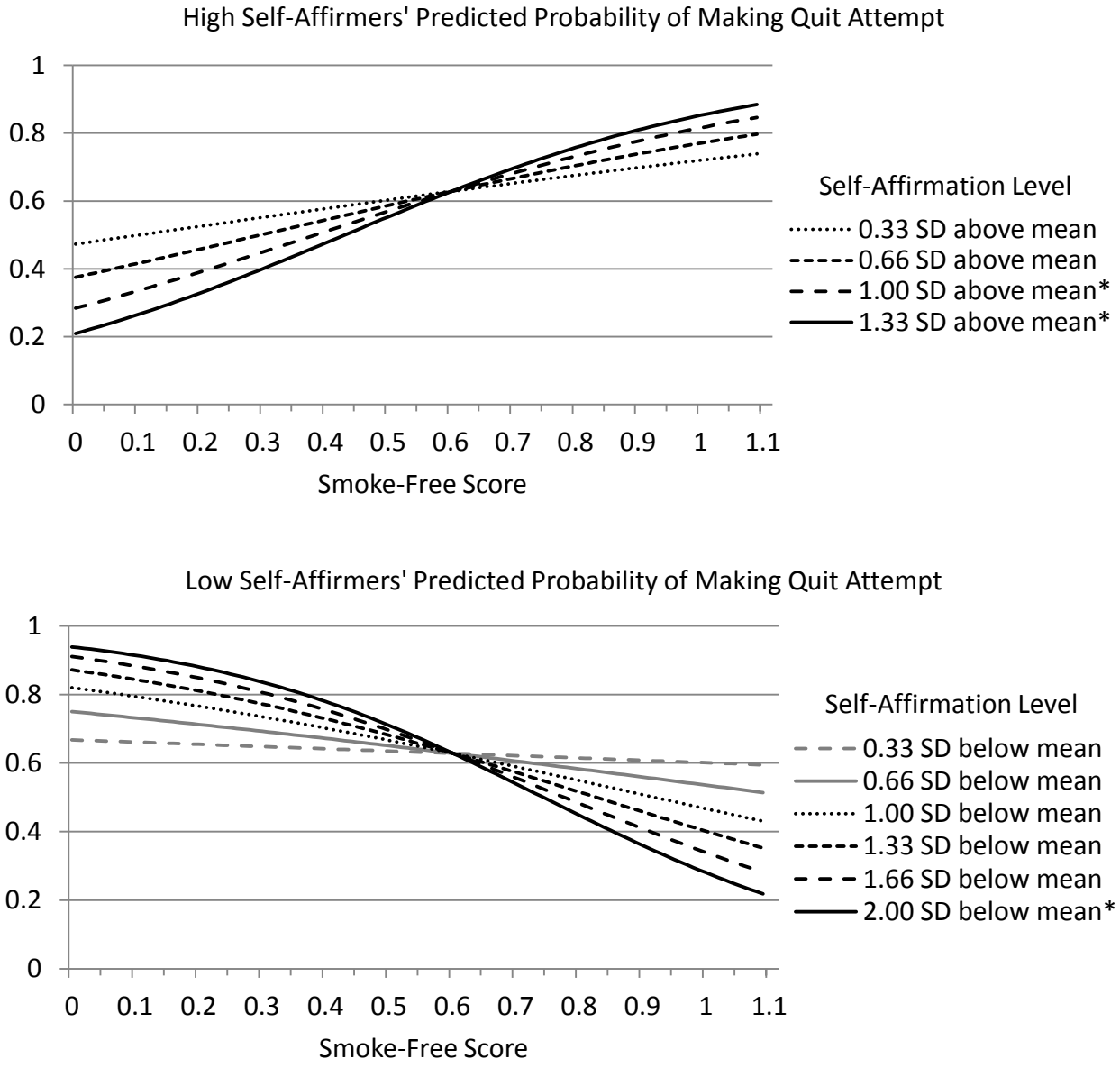

Figure 1. For high self-affirmers, the predicted probability of making a quit attempt increased as smoke-free laws became more comprehensive. For low self-affirmers, the predicted probability decreased as smoke-free laws became more comprehensive.
*: indicates the effect of smoke-free score was significant at $p < .05$

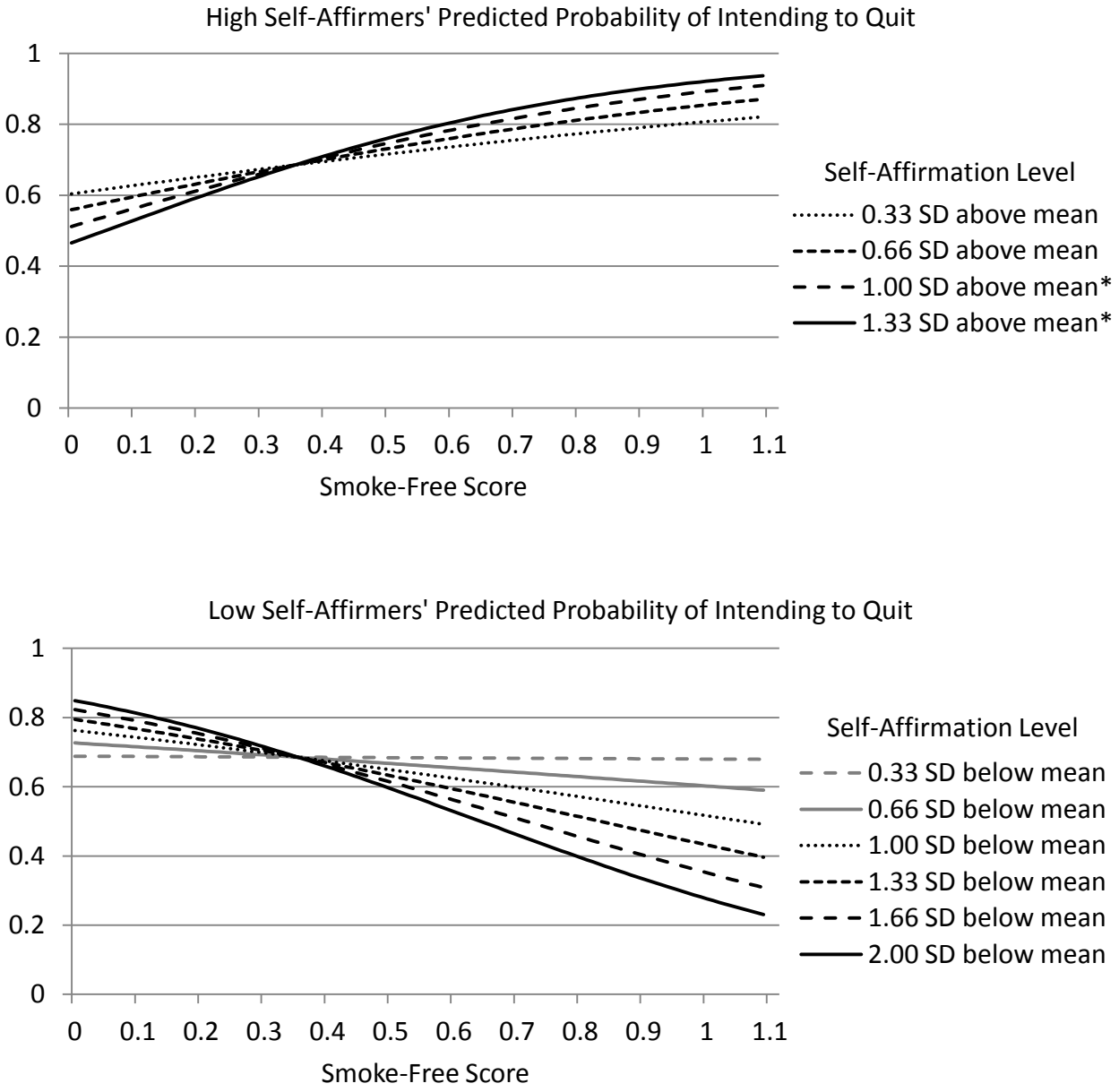

Figure 2. For high self-affirmers, the predicted probability of intending to quit increased as smoke-free laws became more comprehensive. For low self-affirmers, the predicted probability decreased as smoke-free laws became more comprehensive, but this effect did not reach significance even at very low levels of self-affirmation.
*: indicates the effect of smoke-free score was significant at $p < .05$

***Ethics approval/Statement EA not required**

Ethics Approval Statement

This study is based on secondary analyses of data collected by the National Cancer Institute as part of the Health Information National Trends Survey, a national U.S. survey that presented minimal risk to participants and was deemed exempt from Informational Review Board (IRB) approval.